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Barium Tagging for the NEXT Neutrinoless Double Beta Decay Experiment

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In the search for neutrinoless double beta decay, understanding and reducing backgrounds is crucial due to the extremely slow decay rate of the process. An advance that could drive backgrounds to negligible levels would be the ability to efficiently detect the barium daughter of 136-Xe to 136-Ba double beta decay, since no conventional radioactive process can produce barium ions or atoms in xenon. The approach under development by the NEXT collaboration involves transporting the barium ion from the active medium onto a glass plane coated with a barium sensitive fluorescent dye, monitored via fluorescence microscopy. Upon exposure to a barium ion, the dye will begin fluorescing, allowing for a coincident signal with the electron detection at the anode. Our results have shown that single barium ions can be observed using fluorescent dyes and Single Molecule Fluorescent Imaging (SMFI). The next challenge is to realize this technique in a large volume of xenon gas. Significant advances have recently been made, with custom barium-tagging molecules that fluoresce strongly in the dry state when exposed to barium now developed, and devices constructed that can observe fluorescence via in-vacuum or in-gas Total Internal Reflection Fluorescence Microscopy (TIRF-M). This talk presents the latest status of this technique and the outlook for barium tagging in NEXT.

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